

## PATENT ABSTRACTS OF JAPAN

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(71)Applicant : NGK SPARK PLUG CO LTD

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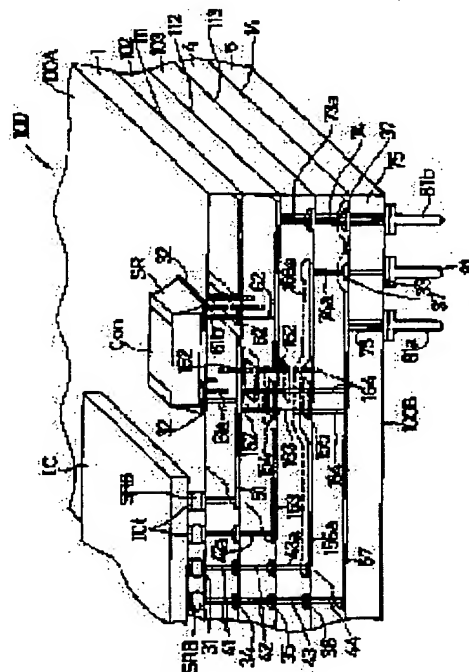
(72)Inventor : NAKANISHI NAOYA  
NOMURA YOSHITOSHI

## 54) MULTILAYERED WIRING BOARD

## 57)Abstract:

PROBLEM TO BE SOLVED: To make electric currents easily flow through ground wiring layer and a power supply wiring layer, by changing the directions of rowed via hole groups extended from a capacitor.

SOLUTION: In a multilayered wiring board, rowed via holes 61 and 62 are extended toward the rear surface 100B of the board. Of the via holes 61 and 62, those via holes 61a are connected to a ground wiring layer 51 provided between first insulating layers 111, and the rowing direction of the holes 61a is turned to a direction which is nearly parallel to a cut line (virtual line) C-C' by means of a turning via hole 162. Between second insulating layers 112, consequently, an insulating pattern formed between a power supply wiring layer 153 and a turning via hole connecting conductor layer which connects turning via holes 162 to each other is extended in nearly parallel to the virtual line C-C', and an electric current flows through a power supply wiring layer 153s between them. Therefore, the resistance of the wiring layer 153 can be lowered. Between third insulating layers 113, in addition, signal wiring 156a can be passed through the space between turned extension via hole groups 163.



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## CLAIMS

[Claim(s)]

[Claim 1] The terminal formation field which is a field which has a front face and a rear face and occupies a part of above-mentioned front face, and contains many IC connection terminals in the interior, The external connection terminal of a large number containing the power supply terminal for supplying the earth terminal and power-source potential for being formed in the above-mentioned front face or a rear face, and supplying touch-down potential to IC chip, The capacitor pad which is formed in the above-mentioned front face or a rear face, and connects a capacitor, It is formed between the insulating layers to which it is a preparation \*\*\*\*\* substrate and a two-layer insulating layer intervenes at least between the fields in which the above-mentioned capacitor pad was formed. A part of flow way which flows through the above-mentioned IC connection terminal, the above-mentioned earth terminal, or a power supply terminal is constituted. The above-mentioned multilayer-interconnection substrate plane view and when it sees through It has the solid conductor layer which spreads between the earth terminals or power supply terminals by which the above-mentioned flow is carried out at least with the above-mentioned terminal formation field. The above-mentioned capacitor pad It is on the imaginary line which ties the above-mentioned earth terminal or power supply terminal which connects the above-mentioned multilayer-interconnection substrate to the above-mentioned terminal formation field and the above-mentioned solid conductor layer plane view and when it sees through. And it is the beer group which the longitudinal direction intersects the above-mentioned imaginary line, is arranged, and is prolonged from the above-mentioned capacitor pad. Maintaining a list, the above-mentioned solid conductor layer, and an insulation at the longitudinal direction of a capacitor pad in the insulating layer which constitutes the field in which a capacitor pad is formed at least It has the beer group prolonged towards an opposite side across between the above-mentioned insulating layers in which this solid conductor layer was formed. The above-mentioned beer group The inside of the two-layer insulating layer which locates and adjoins the field side in which the above-mentioned capacitor pad was formed rather than the above-mentioned solid conductor layer, The beer group formed in the insulating layer by the side of the above-mentioned capacitor pad constitutes one successive installation beer group on a par with the longitudinal direction of the above-mentioned capacitor pad. 1 or two or more conversion beer groups which are located in a line in the parallel direction are constituted, the beer group formed in the insulating layer by the side of the above-mentioned capacitor pad and an opposite side — the above-mentioned imaginary line — abbreviation — Between each beer of a conversion extension beer group and the solid conductor layers which are formed between the above-mentioned two-layer insulating layers, are equipped with the conversion conductor layer which flows through the above-mentioned successive installation beer group and the above-mentioned conversion beer group, and are prolonged in the above-mentioned opposite side side from the above-mentioned conversion beer group or this the insulation between both — maintaining — the above-mentioned imaginary line — abbreviation — the multilayer-interconnection substrate characterized by having the insulating pattern of the configuration prolonged or located in a line in the parallel direction.

[Claim 2] The multilayer-interconnection substrate which is a multilayer-interconnection substrate according to claim 1, and is characterized by being formed between the insulating layer from which said conversion conductor layer constitutes the field in which said capacitor pad was formed, and the insulating layer which adjoins this.

[Claim 3] The multilayer-interconnection substrate characterized by making large spacing of the above-mentioned longitudinal direction of the beer which \*\*\*\*\* in an adjoining conversion beer group as compared with spacing of the longitudinal direction of said capacitor pad of each beer in the above-mentioned successive installation beer group when it has two or more said conversion beer groups which are multilayer-interconnection substrates according to claim 1 or 2, and are connected with said one successive installation beer group.

[Claim 4] The multilayer-interconnection substrate which is a multilayer-interconnection substrate according to claim 3, and is characterized by having the signal wiring inserted into said conversion beer groups or said conversion extension beer groups.

[Translation done.]

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## DETAILED DESCRIPTION

## [Detailed Description of the Invention]

[0001]

[Field of the Invention] The laminating of the conductor layers, such as an insulating layer, a signal wiring layer, and touch-down, a power-source wiring layer, is carried out, and this invention relates to the multilayer-interconnection substrate which equips the front face or rear face with a capacitor especially about the multilayer-interconnection substrate carrying IC chip.

[0002]

[Description of the Prior Art] Conventionally, in order to prevent that a noise invades into touch-down potential or power-source potential in the multilayer-interconnection substrate carrying IC chip, and actuation of IC becomes unstable, inserting a decoupling capacitor between touch-down wiring and power-source wiring is performed. For example, what carries the ceramic chip capacitor which consists of a ceramic of a high dielectric constant in the front face and rear face of a multilayer-interconnection substrate (only henceforth a substrate) is mentioned. moreover, the terminal prepared in IC chip since touch-down potential and power-source potential are needed in every place of IC chip — many (the time abbreviation moiety) — the structure which is used as the terminal for touch-down potential or power-source potential, therefore can pull out touch-down potential and power-source potential by every place of a substrate is searched for. Moreover, in order that touch-down wiring and power-source wiring may pass many currents rather than the usual signal wiring, it is called for that it is low resistance. Since such a demand is filled, solid touch-down wiring and solid power-source wiring may be prepared covering a large area between the insulating layers of a multilayer-interconnection substrate. Furthermore, although electrostatic capacity is not so large inside a substrate, a capacitor may be made to constitute from making such touch-down wiring and power-source wiring counter through an insulating layer.

[0003] By the way, in the usual substrate, IC chip is carried in the surface center of abbreviation, and it considers as the structure of connecting external connection terminals formed in the periphery section of this, a rear face, or a front face, such as a pin and a ball, with wiring formed in the interior of a substrate, in many cases. If plane view is carried out about such a substrate, and an insulating layer is seen through and the circuit pattern of each signal wiring is seen, generally, from IC connection terminal for signals located near an abbreviation center, each signal wiring is prolonged in an outline radial toward the periphery section of a substrate, and connects with the external connection terminal for signals, i.e., it will become the fan-out pattern with which spacing of signal wiring spreads gradually towards outside. Moreover, since the current which flows solid touch-down wiring and solid power-source wiring also passes along the shortest path when connecting with the object for touch-down, or the external connection terminal for power sources through solid touch-down wiring and solid power-source wiring from touch-down or a voltage regulator connection terminal, it is thought that a current flows to an outline radial. In addition, in the above-mentioned explanation, the beer which penetrates each insulating layer and connects a vertical layer is omitted and explained.

[0004] In order to connect the both ends of a capacitor to touch-down potential and power-source potential, respectively as described above in carrying a capacitor in the front face or rear face of a substrate, it is made to connect with touch-down wiring and power-source wiring inside a substrate through beer on the other hand from the capacitor pad prepared in the substrate front face (or rear face). In addition, although this capacitor pad is based also on the electrode configuration of the capacitor to carry, generally, one pair of capacitor pads are formed in parallel with the shape of "=", and each pad is made into the shape of an abbreviation rectangle in many cases. It is made to extend inside a substrate in many cases, forming as much beer as possible that it should consider as connection of low resistance as much as possible since noise rejection capacity will decline if the connection resistance with capacitor and touch-down wiring and power-source wiring becomes large here, connecting both in many cases, installing beer successively for spacing narrowly (putting) as much as possible along with the longitudinal direction of a capacitor pad, and maintaining spacing of beer.

[0005]

[Problem(s) to be Solved by the Invention] However, un-arranging may arise in the relation between the longitudinal direction of a capacitor pad, the sense of the current which flows solid above-mentioned touch-down wiring and above-mentioned solid power-source wiring, or the sense in which signal wiring spreads. Since it is decided in consideration of the property of a substrate, an ease of attachment of a capacitor, etc. which are demanded, how a capacitor is arranged on the surface of a substrate (or rear face) may become the sense of the radial which goes to a periphery, and the crossing sense from the center of a substrate whose longitudinal direction of a capacitor pad is a direction where the sense of the current which flows solid touch-down wiring etc., and signal wiring spread. When the beer installed successively is prolonged in an opposite side (rear-face or front face) side here exceeding a solid touch-down wiring layer and a solid signal wiring layer, it is difficult to form the parts of solid touch-down wiring etc., or to form signal wiring, as it passes along during this period, maintaining the beer and the insulation which were installed successively at narrow spacing. Therefore, in a touch-down wiring layer etc., the insulating pattern prolonged in the longitudinal direction and almost same direction of a capacitor pad is formed in order to maintain the insulation with the beer installed successively. For this reason, since the current which flows a touch-down wiring layer etc. will detour around this insulating pattern and will flow, resistance becomes high relatively. Moreover, since signal wiring is also formed so that it may bypass around the beer installed successively, resistance of signal wiring increases, and when distance becomes long, it produces delay of a signal.

[0006] It explains with reference to the multilayer-interconnection substrate 00 shown in drawing 6. Many flip chip pads 31 which equip with the IC chip IC by flip chip bonding are formed in surface 00A of this substrate 00, and the capacitor pad 32 of the shape of an abbreviation rectangle for fixing and carrying the laminating ceramic chip capacitor Con with Pewter SR is also further formed in it. Moreover, the pin pad 33 was formed in rear-face 00B, and the pin 81 has fixed to it. Between [ 11-14 ] the insulating layers of insulating layers 1-5 of five layers, the touch-down wiring layers 51 and 57 which connect with the flip chip pad 31 through beer 41-44, the power-source wiring layer 53, and signal wiring 56 were formed, and these are connected to the pin pad 33 and a pin 81 through beer 73-75, respectively. Earth terminal and pin 81b becomes [ pin 81a ] a power supply terminal among this pin 81. Moreover, between beer, in order to ensure connection between beer, the beer pads 34-37 are also formed. When it has connected with the touch-down wiring layers 51 and 57 and the power-source wiring layer 53, respectively and Capacitor Con is seen in circuit by the group of the beer 61-64 (successive installation beer 61-64) located in a line with the longitudinal direction (drawing Nakamae back) of the capacitor pad 32 seriate, it intervenes between two-layer [ this ] and has the work which removes the noise produced among these as the so-called decoupling capacitor. It is made for 61 to successive installation beer 64 comrades belonging to one group to have much beer formed at the smallest possible spacing. It is for making [ many ] the number of the beer which can be formed and making connection resistance with a power-source wiring layer and a touch-down wiring layer as small as possible.

[0007] the situation of the power-source wiring layer 53 grade formed in 12 between the 2nd insulating layer here — the plane view from the surface 00A side — and if it sees through, it will become like drawing 7 (a). In addition, in order for this specification to show arrangement of the beer formed up and down in a top view, The beer currently formed in the insulating layer (it will be an insulating layer 2 if it says by this example) which is in the space bottom among the vertical two-layer insulating layers (insulating layers 2 and 3 which adjoin by 12 between the 2nd insulating layer if it says by this example) which adjoin between the considered insulating layers by x mark The beer currently formed in the space bottom (it will be an insulating layer 3 if it says by this example) will be expressed with O mark. Therefore, when beer is lapped and formed in the vertical direction, x mark and O mark may be drawn as it is \*\*\*\*\*. Beer (x mark shows like) 42 connected with the power-source wiring layer 53 formed in 12 between the 2nd insulating layer by spreading through beer 41 from the flip chip pad 31, and beer (O mark shows like) 73 has connected with it through beer 75 and 74 from the pin 81. Therefore, a current will flow between the node of beer 42, and the node of beer 73 among this power-source wiring layer 53. In addition, there are some which are not connected to the power-source wiring layer 53, but connect with beer 43 through the beer pad 35, and are prolonged in the rear-face 00b side in the inside of beer 42.

[0008] By the way, in order to insulate between the successive installation beer connection conductor layer 54 which connects the successive installation beer 62 and 63 comrades which are prolonged from the capacitor pad 32, and the power-source wiring layers 53 which spread in 12 between the 2nd insulating layer, therefore it is long in the vertical direction in drawing 7 (a), in drawing 6, the long insulating pattern 92 of an abbreviation hollow square shape is formed in 12 between the 2nd insulating layer at the cross direction. The capacitor pad 32 is because it is made the long abbreviation rectangle in drawing 6 at the cross direction. if it sees here about beer 42a on cutting-plane-line C-C', and beer 73a — this cutting-plane-line C-C' — since the successive installation beer connection conductor layer 54 and the insulating pattern 92 are also located upwards, as a broken line shows the current which flows during this period in drawing 7 (a), and the successive installation beer connection conductor layer 54 and the insulating pattern 92 are bypassed, it will flow. For this reason, the path along which a current passes becomes long and resistance in the meantime becomes high. That is, the grounding resistance of the power-source wiring layer 53 will go up with such a pattern.

[0009] If similarly plane view of the situation of the signal wiring 56 grade formed in 13 between the 3rd insulating layer is carried out from the surface 00A side, it will become like drawing 7 (b). Since there is a successive installation beer connection conductor layer 55 which connects successive installation beer 63 comrades also in this case, signal wiring 56a which connects beer 43a formed on cutting-plane-line C-C' and beer 74a will avoid the successive installation beer connection conductor layer 55, and will detour greatly. For this reason, the die length of signal wiring 56a becomes long, that resistance goes up, and delay arises to a signal.

[0010] Though it is made in view of this trouble and the front face or rear face of a substrate is equipped with a capacitor pad, this invention converts the successive installation direction of the successive installation beer group prolonged from this capacitor pad, and it is made easy to flow a current in a solid touch-down wiring layer and a solid power-source wiring layer, and it aims at reducing resistance. Furthermore, it makes it possible to connect signal wiring with short distance, and aims at offering a substrate with the signal wiring of low resistance.

[0011]

[Means for Solving the Problem and its Function and Effect] And the terminal formation field which is a field which the solution means has a front face and a rear face, and occupies a part of above-mentioned front face, and contains many IC connection terminals in the interior. The external connection terminal of a large number containing the power supply terminal for supplying the earth terminal and power-source potential for being formed in the above-mentioned front face or a rear face, and supplying touch-down potential to IC chip. The capacitor pad which is formed in the above-mentioned front face or a rear face, and connects a capacitor. It is formed between the insulating layers to which it is a preparation \*\*\*\*\* substrate and a two-layer insulating layer intervenes at least between the fields in which the above-mentioned capacitor pad was formed. A part of flow way which flows through the above-mentioned IC connection terminal, the above-mentioned earth terminal, or a power supply terminal is constituted. The above-mentioned multilayer-interconnection substrate plane view and when it sees through it has the solid conductor layer which spreads between the earth terminals or power supply terminals by which the above-mentioned flow is carried out at least with the above-mentioned terminal formation field. The above-mentioned capacitor pad It is on the imaginary line which ties the above-mentioned earth terminal or power supply terminal which connects the above-mentioned multilayer-interconnection substrate to the above-mentioned terminal formation field and the above-mentioned solid conductor layer plane view and when it sees through. And it is the beer group which the longitudinal direction intersects the above-mentioned imaginary line, is arranged, and is prolonged from the above-mentioned capacitor pad. Maintaining a list, the above-mentioned solid conductor layer, and an insulation at the longitudinal direction of a capacitor pad in the insulating layer which constitutes the field in which a capacitor pad is formed at least It has the beer group prolonged towards an opposite side side across between the above-mentioned insulating layers in which this solid conductor layer was formed. The above-mentioned beer group The inside of the two-layer insulating layer which locates and adjoins the field side in which the above-mentioned capacitor pad was formed rather than the above-mentioned solid conductor layer. The beer group formed in the insulating layer by the side of the above-mentioned capacitor pad constitutes one successive installation beer group on a par with the longitudinal direction of the above-mentioned capacitor pad. 1 or two or more conversion beer groups which are located in a line in the parallel direction are constituted. the beer group formed in the insulating layer by the side of the above-mentioned capacitor pad and an opposite side — the above-mentioned imaginary line — abbreviation — Between each beer of a conversion extension beer group and the solid conductor layers which are formed between the above-mentioned two-layer insulating layers, are equipped with the conversion conductor layer which flows through the above-mentioned successive installation beer group and the above-mentioned conversion beer group, and are prolonged in the above-mentioned opposite side side from the above-mentioned conversion beer group or this the insulation between both — maintaining — the above-mentioned imaginary line — abbreviation — it is the multilayer-interconnection substrate characterized by having the insulating pattern of the configuration prolonged or located in a line in the parallel direction.

[0012] In the multilayer-interconnection substrate of this invention, it has a successive installation beer group, a conversion conductor layer, and a conversion beer group in the field side in which the capacitor pad was formed rather than the solid conductor layer. for this reason, the beer group formed in two insulating layers whose solid conductor layers are pinched — from a conversion beer group or this conversion beer group — further — an opposite side side — turning — extending — a conversion beer group — the same — an imaginary line — abbreviation — it becomes the conversion extension beer group located in a line in the parallel direction. the insulating pattern formed in a solid conductor layer by this in order to maintain the insulation between each beer, such as this conversion beer group, and a solid conductor layer — an imaginary line — abbreviation — it is made the configuration prolonged or located in a line in the parallel direction. since a solid conductor layer, on the other hand, constitutes a part of flow way which flows through the earth terminal (or power supply terminal) linked to IC connection terminal and this solid conductor layer in a terminal formation field — above — an imaginary line — abbreviation — an parallel insulating pattern turns into an insulating pattern which cannot check flow of the current of a solid conductor layer easily. That is, resistance of a solid conductor layer can be decreased and the small substrate of grounding resistance or power-source resistance can be realized. Moreover, the resistance which signal wiring has can also be reduced by connecting with short distance the signal wiring which ties a signal terminal among IC connection terminal in a terminal formation field, and an external connection terminal through between the beer groups prolonged in short distance an epilogue, a conversion beer group, or after this without making it bypass greatly.

[0013] Here, the laminating of many insulating layers is carried out, and, as for a multilayer-interconnection substrate, conductor layers, such as a signal wiring layer, and touch-down, a power-source wiring layer, are formed in the part of between insulating layers. As the quality of the material of an insulating layer, resin composite with inorganic [ such as resin, such as ceramics, such as an alumina, aluminium nitride, and a glass ceramic, and an epoxy resin, BT resin, PPE resin or these and a glass fiber and polyester fiber, ] or organic fiber etc. is mentioned, for example. Moreover, although what is necessary is just to choose the quality of the material of conductor layers, such as a signal wiring layer formed between insulating layers, in consideration of the quality of the material of an insulating layer, when the insulating layer made from a ceramic is used, W, Mo, Mo-Mn, Cu and Ag, Ag-Pt, Ag-Pd, etc. are mentioned, for example. Moreover, when resin and resin composite are used, IC connection terminal to which Cu, nickel, Au,

etc. are mentioned is a connection terminal prepared in order to connect with the terminal formed in IC chip, and, specifically, the flip chip bump for flip chip bonding, the wirebonding pad for wirebonding connection, etc. are mentioned.

[0014] A terminal formation field is a field on the front face of the above-mentioned substrate, the field in which many above-mentioned IC connection terminals were formed to the interior is pointed out, for example, fields, such as the shape of a square or a rectangle and a hollow square shape, are mentioned. An external connection terminal is a connection terminal for being formed in the rear face or front face of a substrate, and connecting with external instruments, such as a mother board and a connector, a pin-like terminal, a ball-like terminal, a land-like terminal, etc. are mentioned, it is arranged by the periphery section of the rear face of a substrate, or a front face in the shape of a grid, and, specifically, terminal structures, such as PGA, BGA, and LGA, are usually constituted, respectively. Although a substrate is the capacitor of another member, and a chip capacitor is used for the capacitor by which the beer which constitutes a beer group penetrates an insulating layer, and is formed, it flows through the wiring layer and conductor layer of an insulating layer which were formed up and down mutually, and gestalten, such as stacked beer and stagger DOBIA, are mentioned in many cases in order to usually make the area and volume a small thing, other capacitors are sufficient as it.

[0015] Here, it is the above-mentioned multilayer-interconnection substrate, and the sum of the cross-sectional area of the beer belonging to said conversion beer group is equal to the sum of the cross-sectional area of the beer belonging to a successive installation beer group, or it is more desirable than this that it is characterized by many things. That there is much cross-sectional area shows that resistance by the whole beer group becomes small. Here, as compared with the case where turned successive installation beer to the opposite side side as it was (without it also changes the cross-sectional area), and it is extended so that it may usually carry out without converting, resistance of a beer group will fall with conversion. That is, it is because it can also reduce resistance of a beer group itself and beer successive installation turn structure not only makes abbreviation parallel the direction where beer is located in a line at an imaginary line, but is further raised in the engine performance of a substrate.

[0016] Furthermore, it is the above-mentioned multilayer-interconnection substrate, and it is good to consider as the multilayer-interconnection substrate characterized by being formed between the insulating layer from which said conversion conductor layer constitutes the field in which said capacitor pad was formed, and the insulating layer which adjoins this.

[0017] In the multilayer-interconnection substrate of this invention, the conversion conductor layer is formed between the insulating layer which constitutes the field in which the capacitor pad was formed, and the insulating layer which adjoins this. That is, a conversion conductor layer is formed in the insulating layer which adjoins the insulating layer which constitutes the field (for example, front face) in which the capacitor pad was formed at a successive installation beer group and this between conversion beer groups and these insulating layers. Therefore, rather than this conversion conductor layer, with the field in which the capacitor pad was formed, since grounding resistance, power-source resistance, and signal wiring resistance can be reduced or the small signal wiring of resistance can be easily formed in the solid layer layer and signal wiring layer which are formed between the insulating layers in an opposite side side, the number between the insulating layers from which such effectiveness is acquired can be increased most.

[0018] Furthermore, when it has two or more said conversion beer groups linked to said one successive installation beer group, it is good [ it is the above-mentioned multilayer-interconnection substrate, and ] to consider as the multilayer-interconnection substrate characterized by making large spacing of the above-mentioned longitudinal direction of the beer which \*\*\*\*\* in an adjoining conversion beer group as compared with spacing of the longitudinal direction of said capacitor pad of each beer in the above-mentioned successive installation beer group.

[0019] the conversion beer group which adjoins in the multilayer-interconnection substrate of this invention as compared with spacing of the beer in a successive installation beer group when it sees about spacing of the longitudinal direction of a capacitor pad — spacing of the beer which each carry out a group is made large. For this reason, the solid conductor layer of comparatively large width of face can be formed among the insulating patterns formed in order that such a conversion beer group or a conversion extension beer group may maintain a conversion beer group or a conversion extension beer group, and an insulation in the solid conductor layer formed between the insulating layers currently formed in the up-and-down insulating layer. Therefore, since it passes along the solid conductor layer between this insulating pattern and the current between IC connection terminal-earth terminals (or power supply terminal) flows, a substrate with still smaller grounding resistance and power-source resistance is realizable. Moreover, between the insulating layers by which such a conversion beer group or the conversion extension beer group is formed in the up-and-down insulating layer, since spacing of beer groups can be made large, also dimensionally and geometrically it becomes easy to form signal wiring in the meantime, and the small signal wiring of resistance can be formed easily. Moreover, it may become possible to let two or more signal wiring pass, in that case more much signal wiring can be connected with short distance to this beer between groups one, and that resistance can be reduced to it.

[0020] Furthermore, it is good to consider as the multilayer-interconnection substrate characterized by having the signal wiring inserted into said conversion beer groups or said conversion extension beer groups.

[0021] In the multilayer-interconnection substrate of this invention, since signal wiring was formed among conversion beer groups and the die length of signal wiring can be made more into short distance, the resistance which signal wiring has can be reduced more.

[0022]

[Embodiment of the Invention] The gestalt of operation of this invention is explained with a drawing. Since it is only that the above-mentioned conventional substrate 00 differs from the method of a list of the beer prolonged from the capacitor pad 32, the configuration of the rear, etc., the substrate 100 of this operation gestalt is explained focusing on a different part, about the same part, attaches the same number, and omits or simplifies explanation. As show in sectional view drawing 1 and explanatory view drawing 2 in the condition of having see from surface 100A (a), in terminal formation field 31S of the center of abbreviation of surface 100A of this substrate 100, many flip chip pads 31 for connect the IC chip IC be form in the shape of a grid, and the capacitor pad 32 of the shape of an abbreviation rectangle for fix and carry Capacitor Con be also form on surface 100A still the more nearly same. Moreover, near the periphery of rear-face 100B, the pin pad 33 was formed in the shape of a grid, and the pin 81 has fixed. Although not described above, the situation of substrate surface 100A shown in drawing 2 (a) is the same also in the above mentioned conventional substrate 00.

[0023] This substrate 100 is the product made from a ceramic which uses an alumina as a principal component, and the laminating of the insulating layers 1, 102, 103, 4, and 5 of five layers is carried out. Among [ 111, 112, 113, and 14 ] these insulating layers The touch-down wiring layers 51 and 57 which connect with the flip chip pad 31 through beer 41-44, the power-source wiring layer 153, and signal wiring 156 were formed, and these are connected to the pin pad 33 and a pin 81 through beer 73-75, respectively. Earth terminal and pin 81b of pin 81a is a power supply terminal among this pin 81. moreover, beer pad 34- for absorbing the location gap between beer and connecting certainly between the insulating layers between beer 41-44 and beer 74 and 75, — 36 and 37 are formed. Each of these pads, wiring layers, and beer consists of a conductor which uses a tungsten as a principal component, and is formed by the coincidence calculating method with the insulating layer made from a ceramic. The group of the successive installation beer 61 (61a, 61b) and 62 located in a line with the longitudinal direction (drawing Nakamae back) of the capacitor pad 32 seriate connects with the touch-down wiring layer 51 and the power-source wiring layer 53, and the capacitor Con as well as the conventional substrate 00 (refer to drawing 6 ) is functioning as a decoupling capacitor in circuit by it. It has connected also with the touch-down wiring layer 57 with conversion beer 162 or conversion extension beer 163,164 so that it may following-\*. Moreover, as [ spacing of successive installation beer 61 and 62 comrades ] usual, in order to make resistance small, it considers as the smallest possible spacing.

[0024] Subsequently, plane view and the condition of having seen through are shown in drawing 2 (b) from the surface 100A side about the situation of the touch-down wiring layer 51 grade formed in 111 between the 1st insulating layer. The touch-down wiring layer 51 is a conductor layer which spreads all over the abbreviation except a center section among 111 between insulating layers. Some of the beer 41 prolonged from the flip chip pad 31 (3 are shown by x mark in this example) have connected with this touch-down wiring layer 51. Others are prolonged toward a lower part (rear-face side) with the beer 42 shown by O mark formed in the space lower part through the beer pad 34 formed in 111 between insulating layers. From the



capacitor pad 32, the inside of an insulating layer 1 is turned to the rear-face 100B side, and it extends, and among the successive installation beer 61 which extended to 111 between insulating layers, each connects the group (it sets to drawing and they are three pieces) of successive installation beer 61b of the right-hand side in drawing by the successive installation beer connection conductor layer 52, and in order to maintain the touch-down wiring layer 51 and an insulation, the insulating pattern 91 of an abbreviation hollow square shape is formed in the surroundings of it. In addition — the successive installation beer connection conductor layer 52 — successive installation beer 61b — respectively — the upper and lower sides — it was formed in the same location and the successive installation beer 62 prolonged toward the rear-face 100B side has connected.

[0025] On the other hand, among successive installation beer 61, the group (it sets to drawing and they are three pieces) of successive installation beer 61a of the left-hand side in drawing is connected to the touch-down wiring layer 51, as x mark shows, respectively. Furthermore — although this successive installation beer 61a is prolonged towards the rear-face 100B side and it connects with another touch-down wiring layer 57 — each successive installation beer 61 and the upper and lower sides — it is not formed in the same location. As O mark shows among drawing 2 (b), conversion beer 162 is arranged in every two sense (the inside of drawing 2 (b), space longitudinal direction) parallel to cutting-plane-line C-C' to having ranked [ a thing and successive installation beer 61a (61a1, 61a2, 61a3) cross at right angles to cutting-plane-line C-C' ] with it being suitable (the inside of drawing 2 (b), the space vertical direction). Thereby, one group of successive installation beer 61a which consists of three beer is made into the group of two conversion beer 162 with which two conversion beer 162 belongs, respectively. That is, it is group 162G2 which consists of conversion beer 162c and 162d as well as group 162G1 which consists of conversion beer 162a and 162b. And conversion beer 162 was respectively arranged one piece at a time among three successive installation beer 61a at the successive installation beer 61a1 of both ends, and right and left of 61a3 among drawing. For this reason, spacing of the beer which carry out a group to group 162G1, 162G2 of two conversion beer, respectively becomes twice spacing of successive installation beer 61a.

[0026] next, the situation of the power-source wiring layer 153 grade formed in 112 between the 2nd insulating layer — the plane view from the surface 100A side — and when it sees through, it comes to be shown in drawing 3 (a). In the power-source wiring layer 153 formed in 112 between the 2nd insulating layer by spreading Since beer (x mark shows like) 42 connected through beer 41 from the flip chip pad 31 and beer (O mark shows like) 73 has connected through beer 75 and 74 from the pin 81 It is the same as that of said substrate 00 that a current will flow between the node of beer 42 and the node of beer 73 among the touch-down wiring layers 153. Here, with this operation gestalt, as for the direction where the group of successive installation beer 61a is located in a line as described above, the direction is converted by group 162G1, 162G2 of conversion beer 162 through the touch-down wiring layer 51. For this reason, as for the conversion beer connection conductor layers 154a and 154b which connect conversion beer 162 comrades (this example two) which accomplish one group, unlike the case of the above mentioned conventional substrate 00 (refer to drawing 7 (a)), that longitudinal direction is formed in abbreviation parallel at cutting-plane-line C-C'. In addition, this cutting-plane-line C-C' is also the imaginary line which connects terminal formation field 31S shown with the alternate long and short dash line in drawing 3 (a), and power supply terminal 81b. Furthermore, if it says, it is the imaginary line which connects beer 42a linked to the power-source wiring layer 153, and beer 73a. And since these two spacing of group 162G1, 162G2 is made large as described above, even if it forms the insulating patterns 192a and 192b of an oblong-among drawing abbreviation hollow square shape for an insulation with the power-source wiring layer 153 in the surroundings of the conversion beer connection conductor layers 154a and 154b, respectively, 153s of power-source wiring layers can be formed between them.

[0027] Therefore, a drawing destructive line comes to show the current which flows between the node of beer 42, and the node of beer 73, and the part takes the path in which the distance which passes along 153s of power-source wiring layers between the insulating patterns 192a and 192b is short. Therefore, the resistance which the power-source wiring layer 153 has was able to be made to decrease as compared with the conventional case. Moreover, since that path becomes short as compared with the case of drawing 7 (b), the current which flows between the beer 42 and beer 73 which are located in addition to on cutting-plane-line C-C' when a current passes along 153s of power-source wiring layers also makes resistance of the power-source wiring layer 153 fall also from this point, and conversion beer 162 and the upper and lower sides — the conversion extension beer 163 formed in the same location is further prolonged in the rear-face 100B side.

[0028] If similarly plane view of the situation of the signal wiring 156 grade formed in 113 between the 3rd insulating layer is carried out from the surface 100A side, it will become like drawing 3 (b). Since there are conversion extension beer connection conductor layers 155a and 155b which connect conversion extension beer 163 and 164 comrades also in this case, since signal wiring 156a which connects beer 43a formed on cutting-plane-line C-C' and beer 74a can let between the conversion extension beer connection conductor layers 155a and 155b pass, bypassing slightly is only sufficient for it. For this reason, the die length of signal wiring 156a can be shortened, that resistance is reduced, and delay of a signal can be prevented. Moreover, since signal wiring 156a passes along between the conversion extension beer connection conductor layers 155a and 155b, other signal wiring 156 can connect between beer now by short distance, and can reduce resistance of signal wiring similarly, and delay can also be prevented.

[0029] Thus, in the substrate 100 of this operation gestalt, since the direction where the group of successive installation beer 61a prolonged from the capacitor pad 32 is located in a line was changed by the group of the touch-down wiring layer 51 and conversion beer 162, resistance of the power-source wiring layer 153 or the signal wiring layer 156 was able to be reduced. In addition, with this operation gestalt, conversion beer 162 (for example, a [ 162 ] and 162b) and conversion extension beer 163, 164 comrades which accomplish one group were mutually connected by the conversion beer connection conductor layers 154a and 154b or the conversion extension beer connection conductor layers 155a and 155b. When an open circuit arises from one beer, if a conversion beer connection conductor layer is not formed, all the beer with which the beer is connected up and down will be un-flowing, but if the conversion beer connection conductor layer is formed, while only disconnected beer needs to be un-flowing and the rise of resistance by open circuit will be suppressed to the minimum, it is because the dependability of wiring can also do highly. However, after taking dependability etc. into consideration, Lycium chinense grows without connecting beer. In this case, the insulating pattern between conversion beer 162 and the power-source wiring layer 153 will be located in a line with abbreviation parallel at cutting-plane-line (imaginary line) C-C'.

[0030] In the above-mentioned operation gestalt, the direction of successive installation beer was converted by the group of the successive installation beer 61 formed in the insulating layer 1, the touch-down wiring layer 51 formed in 111 between insulating layers, and the group of the conversion beer 62 formed in the insulating layer 2. In addition, in 12 between insulating layers 2 and 3 and these insulating layers, the direction of successive installation beer may be converted like the above. However, about the power-source wiring layer formed in 112 between insulating layers, although a path as well as the above-mentioned operation gestalt can be shortened and resistance of signal wiring can be reduced about the signal wiring 162 formed in 113 between insulating layers in this case, since it becomes the same configuration as the power-source wiring layer 53 in the above mentioned conventional substrate 00 (refer to drawing 6 and drawing 7 (a)), resistance of a power-source wiring layer cannot be reduced. Therefore, it is desirable to convert the direction of successive installation beer in the location near the capacitor pad 32 as much as possible so that this may also show. That is, it is desirable to form the conversion conductor layer (touch-down wiring layer 51 in the above-mentioned operation gestalt) which both successive installation beer 61 and conversion beer 62 connect between the insulating layer 1 which makes the field (this operation gestalt surface 100A) in which the capacitor pad 32 was formed, and the insulating layer 102 which adjoins this.

[0031] In the above-mentioned operation gestalt, the structure which makes the group (three pieces) of successive installation beer 61 the group (2 piece x2) of two conversion beer 162 was used. Moreover, the touch-down wiring layer 51 was used as a conductor layer which connects both successive installation beer and conversion beer. However, it may not be limited to this and you may be other structures. For example, as shown in drawing 4 (a), the group of five successive installation beer 261 on a par with the drawing Nakamae back may be converted into the group of the conversion beer 262a, 262b, and 262c which it locates in a line with the longitudinal direction in drawing two pieces at a time through the conversion conductor layer 251 of the shape of an abbreviation rectangle formed between the insulating layers of the insulating layer which is not illustrated. In addition, since it described above, conversion beer 262a etc. is good respectively to make it flow mutually by the conversion beer connection conductor layers 254a, 254b, and 254c. Speaking concretely, being able to form a solid conductor layer (not shown), such as a touch-down wiring layer

and a power-source wiring layer, among the conversion beer connection conductor layers 254b and 254c, for example between conversion beer 262b and 262c, after forming the insulating pattern (not shown) which maintained predetermined insulation distance, if it does in this way. Moreover, it can let a signal wiring layer pass among the conversion beer connection conductor layers 254b and 254c. Therefore, since a sink or a signal can be transmitted for a current to the longitudinal direction in drawing as there is no need of avoiding the group of seriate beer and bypassing, like before and an arrow head shows, resistance of solid-like conductor layers, such as a touch-down wiring layer, can be reduced, or resistance of signal wiring can be reduced, and delay of a signal can be prevented.

[0032] Moreover, as shown in drawing 4 (b), you may make it the structure which converts the group of five successive installation beer 361 on a par with the drawing Nakamae back into the group of five conversion beer 362 on a par with the longitudinal direction in drawing through the conversion conductor layer 351 of the abbreviation cross-joint configuration formed between the insulating layers of the insulating layer which is not illustrated. In addition, conversion beer 362 is good to make it flow mutually by the conversion beer connection conductor layer 354, respectively. Also when it does in this way, after maintaining predetermined insulation distance, a solid conductor layer (not shown), such as a touch-down wiring layer, can be formed between conversion beer 362 or the conversion beer connection conductor layer 354 to near conversion beer 362 or the conversion beer connection conductor layer 354. Moreover, it can let a signal wiring layer pass near conversion beer 362 or the conversion beer connection conductor layer 354. Therefore, when it does in this way, similarly, resistance of solid-like conductor layers, such as a touch-down wiring layer, can be reduced, or resistance of a signal wiring layer can be reduced, and delay of a signal can be prevented.

[0033] The example shown in the above-mentioned operation gestalt and drawing 4 (a), and (b) showed the case where the direction where successive installation beer is located in a line, and the direction where conversion beer is located in a line carried out the abbreviation rectangular cross of the substrate. However, since this invention acquires effectiveness, such as the current which flows a solid-like conductor layer being barred, or preventing that the path of a signal wiring layer is detoured, and lowering resistance of a solid-like conductor layer or a signal wiring layer by the group of successive installation beer, it is clear that it is not necessary its to lie at right angles. It seems that for example, it may be shown in drawing 4 (c). Drawing 4 (c) is shown in the condition when carrying out plane view of the substrate on the basis of between the insulating layers which form the conversion conductor layer 451, and seeing through each insulating layer. The group of five successive installation beer 461 which it is formed in the upper (on space) insulating layer, and is shown by x mark is connected to a list and the conversion conductor layer 451 drawing Nakagami down. It connects with a list in the direction of slant of a drawing Nakamigi riser, and the group of the conversion beer 462a, 462b, and 462c which the insulating layer of a lower layer (under space) is formed, and is shown by O mark on the other hand has connected it two pieces at a time to the conversion conductor layer 451 at this appearance, respectively. Moreover, it has flowed through conversion beer 462a etc. mutually by the conversion beer connection conductor layers 454a, 454b, and 454c, respectively. When it does in this way, for example, as shown in drawing 4 (c), the path of a signal wiring layer can also be shortened in the direction of slant by letting the signal wiring layer 456 pass between conversion beer 462a and 462b (i.e., between the conversion beer connection conductor layers 454a and 454b). Moreover, resistance of a solid layer layer can also be lowered by replacing with the signal wiring layer 456 and forming a solid conductor layer in the meantime.

[0034] Furthermore, above, although each group of successive installation beer was located in a line with one train, it is not limited to this. For example, as shown in drawing 5 (a), also when five successive installation beer 561 each which expresses with x mark is located in a line with two trains, the conversion conductor layer 551 may be used, and you may convert so that four conversion beer 562a, 562b, and 562c may be located in a line with three trains in the longitudinal direction in drawing, respectively. In this case, four conversion beer 562a, 562b, and 562c each is mutually connected by the conversion beer connection conductor layers 554a, 554b, and 554c between the layers below space, respectively. Moreover, as shown in drawing 5 (b), also when five successive installation beer 661 which expresses with x mark is located in a line with zigzag, the conversion conductor layer 651 may be used, and you may convert so that three conversion beer 662a and 662b may be located in a line with two trains in the longitudinal direction in drawing. In this case, three conversion beer 662a and 662b each is mutually connected by the conversion beer connection conductor layers 654a and 654b between the layers below space, respectively.

[0035] In addition, the number of the sum totals of conversion beer is equal, or he is trying to all increase more than it as compared with the number of successive installation beer with the above-mentioned operation gestalt, drawing 4, and the successive installation beer turn structure shown in drawing 5. In order to obtain the function of a decoupling capacitor enough, the thing small as much as possible of a capacitor pad, a touch-down wiring layer or a power-source wiring layer, and connection resistance of a between is desirable. It is because connection resistance with a capacitor pad and a touch-down wiring layer will go up, so it is desirable to make [ many ] the number of conversion beer rather if the cross-sectional area of each beer is equal and the number of conversion beer is lessened as compared with the number of the successive installation beer prolonged from a capacitor pad. Since it is the same, when the cross-sectional area of each beer can be changed, it is desirable to make [ many ] it whether it is equal in the sum total of the cross-sectional area of conversion beer as compared with the sum total of the cross-sectional area of successive installation beer. Moreover, although the above-mentioned operation gestalt and drawing 4 (c) showed the case where the number of the signal wiring which lets between the groups of conversion beer (or conversion extension beer) pass was one, it is clear that you may be [ two or more ]. Furthermore, with the above-mentioned operation gestalt, although each conversion beer connection conductor layer showed the parallel example mutually, I hope that these are not parallel, for example, plane view and when it sees through, a substrate may not necessarily be formed so that it may become a radial centering on a terminal formation field.

[0036] Although it was based on an operation gestalt and various kinds of modifications and this invention was explained above, this invention is the range which is limited to neither the above-mentioned operation gestalt nor a modification, and does not deviate from the summary, and it cannot be overemphasized that it changes suitably and can apply. For example, although the capacitor pad 32 was formed in surface 100A which carries the IC chip IC in the substrate 100 of the above-mentioned operation gestalt, this invention may be applied to what was formed in rear-face 100B by the side of reverse. Moreover, in the substrate 100 of the above-mentioned operation gestalt, although the pin pad 33 and the pin 81 were formed near the periphery of rear-face 100B, this invention may be applied to what was formed in surface 100A. Moreover, in one, the capacitor carried in the front face or rear face of a substrate may not be restricted, but plural is sufficient as it. Therefore, it is clear that the successive installation beer turn structure of this invention may be applied by every place of a substrate about the successive installation beer prolonged from the capacitor pad furnished with these capacitors.

[Translation done.]



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## DESCRIPTION OF DRAWINGS

## [Brief Description of the Drawings]

[Drawing 1] It is the partial fracture sectional view showing the structure of the multilayer-interconnection substrate concerning the operation gestalt 1.

[Drawing 2] In the multilayer-interconnection substrate of drawing 1, the explanatory view showing the situation of the beer arrangement formed in IC connection terminal with which (a) was formed in the front face, and the insulating layer of the upper and lower sides, and (b) are the explanatory views showing the situation of the beer arrangement formed in the conductor layer (conversion conductor layer) formed between the 1st insulating layer, and the insulating layer of the upper and lower sides.

[Drawing 3] In the multilayer-interconnection substrate of drawing 1, the explanatory view showing the situation of the beer arrangement formed in the solid conductor layer by which (a) was formed between the 2nd insulating layer, and the insulating layer of the upper and lower sides, and (b) are the explanatory views showing the situation of the beer arrangement formed in the signal wiring layer formed between the 3rd insulating layer, and the insulating layer of the upper and lower sides.

[Drawing 4] Although it is the explanatory view showing the example of other beer conversion structures and (a) of what made the conversion beer group one train, and (b) is the same as that of the operation gestalt 1, that which the conversion conductor layer became independent of, and (c) show that to which the direction to which a successive installation beer group is connected, and the direction to which a conversion beer group is connected are slanting.

[Drawing 5] It is the explanatory view showing the example of other beer conversion structures, and, as for (a), a successive installation beer group shows what has been arranged alternately, as for that whose successive installation beer groups are two trains, and (b).

[Drawing 6] It is the partial fracture sectional view showing the structure of the conventional multilayer-interconnection substrate.

[Drawing 7] In the multilayer-interconnection substrate of drawing 6, the explanatory view showing the situation of the beer arrangement formed in the solid conductor layer by which (a) was formed between the 2nd insulating layer, and the insulating layer of the upper and lower sides, and (b) are the explanatory views showing the situation of beer arrangement formed in the signal wiring layer formed between the 3rd insulating layer, or the insulating layer of the upper and lower sides.

## [Description of Notations]

100 [ ] Multilayer-Interconnection Substrate (Substrate)

1, 102, 103, 4, 5 Insulating layer

111, 112, 113, 14 Between insulating layers

31 [ ] Flip Chip Pad

31S Terminal formation field

32 [ ] Capacitor Pad

33 [ ] Pin Pad

34, 35, 36, 37 Beer pad

41, 42, 43, 44 Beer

51 57 Touch-down wiring layer

153 [ ] Power-Source Wiring Layer

154 [ ] Conversion Beer Connection Conductor Layer

155 [ ] Conversion Extension Beer Connection Conductor Layer

61 62 Successive installation beer

162 [ ] Conversion Beer

163,164 Conversion extension beer

73, 74, 75 Beer

81 [ ] Pin

261 361,461,561,661 Successive installation beer

251 351,451,551,651 Conversion conductor layer

262 362,462,562,662 Conversion beer

254 354,454,554,654 Conversion beer connection conductor layer

[Translation done.]

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[Drawing 1]



Diagram illustrating a second embodiment of the display device. It shows a 3x3 grid of pixels. The central pixel is labeled 551. The pixels are arranged in three rows and three columns. The top row is labeled 554a, the middle row is labeled 554b, and the bottom row is labeled 554c. The left column is labeled 554a, the middle column is labeled 554b, and the right column is labeled 554c. The central pixel is labeled 561. The pixels in the top row are labeled 562a, 561, and 562a. The pixels in the middle row are labeled 562b, 561, and 562b. The pixels in the bottom row are labeled 562c, 561, and 562c.

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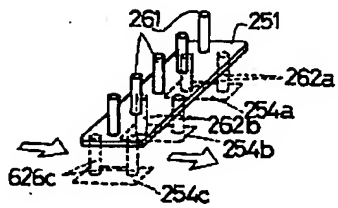
(a)

(b)

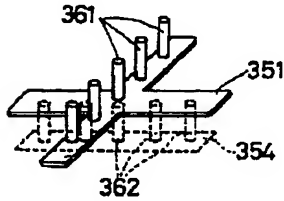
Diagram (b) illustrates a cross-sectional view of a device. A central horizontal layer, labeled 156, is positioned between two other horizontal layers, 155a (top) and 155b (bottom). Below these layers are two more horizontal layers, 163 and 164. A vertical layer, labeled 56, is located on the left side, extending upwards. On the right side, there is a vertical layer labeled 113. Various points and features are labeled: 36 (top left), 43, 44, 43a, 156a, 163, 164, 155b, 74a, 73a, 74, and 73, 74. A dashed line labeled C-C' runs horizontally across the bottom of the diagram.

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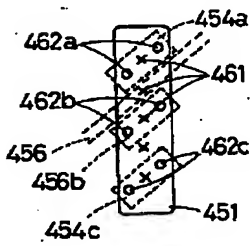
(a)



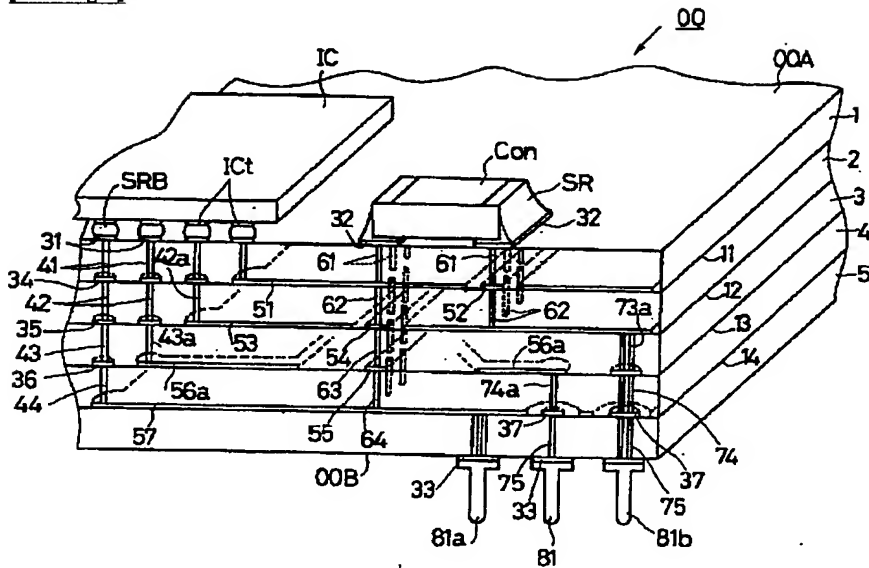
(b)



(c)



[Drawing 6]



[Drawing 7]

Fig. 1 is a schematic diagram of a magnetic field distribution. It shows a cross-section of a detector with a central region (54) and a surrounding region (53). A dashed line (52) represents a magnetic field boundary. A vertical line (73) is on the right. Labels include 35, 42, 43, 42a, 92-62, 63, 73a, and 62.

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(71) 出願人 000004547

日本特殊陶業株式会社

愛知県名古屋市瑞穂区高辻町14番18号

(72) 発明者 中西 直也

名古屋市瑞穂区高辻町14番18号 日本特殊  
陶業株式会社内

(72) 発明者 野村 俊寿

名古屋市瑞穂区高辻町14番18号 日本特殊  
陶業株式会社内

(74) 代理人 100104167

弁理士 奥田 誠 (外2名)

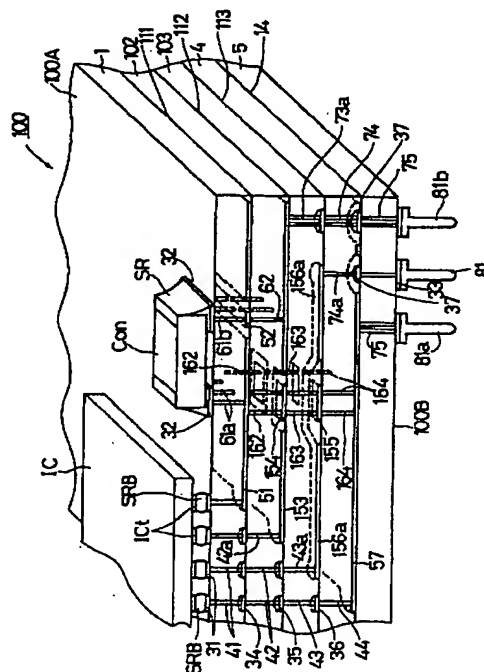
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(54) 【発明の名称】 多層配線基板

(57) 【要約】 (修正有)

【課題】 コンデンサパッドから延びる列設ビア群の列設方向を転換して、ベタ状の接地配線層や電源配線層において電流を流れやすくする。

【解決手段】 列設ビア61、62が裏面100B側に向かって延びるが、このうち、列設ビア61aは、第1絶縁層間111に設けた接地配線層51に接続し、転換ビア162によって切断線(仮想線)C-C'に略平行な方向に並ぶようにする。このため、第2絶縁層間112において、電源配線層153と転換ビア162同士を接続する転換ビア接続導体層との間に形成される絶縁パターンが、仮想線C-C'に略平行に延びる形状となり、これらの間の電源配線層153sを通じて電流が流れるので、電源配線層153の抵抗を低下させることができる。また、第3絶縁層間113においても、信号配線156aを転換延長ビア163の群同士の間を通すことができる。



## 【特許請求の範囲】

【請求項1】 表面と裏面とを有し、  
上記表面の一部を占める領域であって、その内部にIC  
接続端子を多数含む端子形成領域と、  
上記表面または裏面に形成され、ICチップに接地電位  
を供給するための接地端子および電源電位を供給するた  
めの電源端子を含む多数の外部接続端子と、  
上記表面または裏面に形成され、コンデンサを接続する  
コンデンサパッドと、を備える多層配線基板であって、  
上記コンデンサパッドが形成された面との間に少なくと  
も2層の絶縁層が介在する絶縁層間に形成され、上記IC  
接続端子と上記接地端子または電源端子とを導通する  
導通路の一部を構成し、上記多層配線基板を平面視かつ  
透視したときに、少なくとも上記端子形成領域と上記導  
通される接地端子または電源端子との間に広がるベタ導  
体層を備え、  
上記コンデンサパッドは、上記多層配線基板を平面視か  
つ透視したときに、上記端子形成領域と上記ベタ導体層  
に接続する上記接地端子または電源端子とを結ぶ仮想線  
上にあり、しかもその長手方向が上記仮想線に交差して  
配置されており、  
上記コンデンサパッドから延びるビア群であって、少な  
くともコンデンサパッドが形成される面を構成する絶縁  
層においてコンデンサパッドの長手方向に並び、上記ベ  
タ導体層と絶縁を保ちつつ、このベタ導体層が形成され  
た上記絶縁層間を越えて反対面側にに向けて延びるビア群  
を備え、  
上記ビア群は、  
上記ベタ導体層よりも上記コンデンサパッドが形成され  
た面側に位置し隣接する2層の絶縁層のうち、  
上記コンデンサパッド側の絶縁層に形成されたビア群  
が、上記コンデンサパッドの長手方向に並ぶ1つの列設  
ビア群を構成し、  
上記コンデンサパッドと反対面側の絶縁層に形成された  
ビア群が、上記仮想線に略平行な方向に並ぶ1または複  
数の転換ビア群を構成し、  
上記2層の絶縁層間に形成され、上記列設ビア群と上記  
転換ビア群とを導通する転換導体層を備え、  
上記転換ビア群またはこれより上記反対面側に延びる転  
換延長ビア群の各ビアとベタ導体層との間に、両者間の  
絶縁を保ち、上記仮想線に略平行な方向に延びまたは並  
ぶ形状の絶縁パターンを備えることを特徴とする多層配  
線基板。

【請求項2】 請求項1に記載の多層配線基板であ  
って、  
前記転換導体層が、前記コンデンサパッドが形成された  
面を構成する絶縁層とこれに隣接する絶縁層との間に形  
成されていることを特徴とする多層配線基板。

【請求項3】 請求項1または請求項2に記載の多層配  
線基板であって、1つの前記列設ビア群と接続する前記

転換ビア群を複数備える場合において、

上記列設ビア群における各ビア同士の前記コンデンサパ  
ッドの長手方向の間隔に比して、隣接する転換ビア群に  
それぞれ属するビア同士の上記長手方向の間隔が広くさ  
れていることを特徴とする多層配線基板。

【請求項4】 請求項3に記載の多層配線基板であって、  
前記転換ビア群同士、または前記転換延長ビア群同士に  
挟まれた信号配線を備えることを特徴とする多層配線基  
板。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】 本発明は、絶縁層と信号配線  
層や接地・電源配線層などの導体層が積層され、ICチ  
ップを搭載する多層配線基板に関し、特に、その表面ま  
たは裏面にコンデンサを装着する多層配線基板に関す  
る。

## 【0002】

【従来の技術】 従来より、ICチップを搭載する多層配  
線基板においては、接地電位や電源電位にノイズが侵入  
してICの動作が不安定になるのを防止するため、接地  
配線と電源配線との間にデカップリングコンデンサを挿  
入することが行われている。例えば、高誘電率のセラミ  
ックからなるセラミックチップコンデンサを、多層配線  
基板（以下、単に基板ともいう）の表面や裏面に搭載す  
るものが挙げられる。また、接地電位や電源電位はIC  
チップの各所において必要とされるため、ICチップに  
設ける端子の多く（時には約半数）が接地電位や電源電  
位のための端子とされ、従って、基板の各所で接地電位  
や電源電位を引き出せるような構造が求められる。ま  
た、接地配線や電源配線は、通常の信号配線よりも多く  
の電流を流すため、低抵抗であることが求められる。こ  
のような要求を満たすため、多層配線基板の絶縁層間に  
広い面積にわたって、ベタ状の接地配線や電源配線を設  
けることがある。さらに、このような接地配線と電源配  
線とを絶縁層を介して対向させることで、基板内部に静  
電容量はあまり大きくないものの、コンデンサを構成さ  
せる場合もある。

【0003】 ところで、通常の基板においては、表面の  
略中央にICチップを搭載し、これと裏面あるいは表面  
の周縁部に形成したピンやボールなどの外部接続端子と  
を、基板内部に形成した配線によって接続する構造とす  
ることが多い。このような基板について平面視しかつ絶  
縁層を透視して、各信号配線の配線パターンを見ると、  
一般に、各信号配線が、略中央付近に位置する信号用の  
IC接続端子から、基板の周縁部に向かって概略放射状  
に延びて信号用の外部接続端子に接続する、つまり信号  
配線の間隔が外に向けて徐々に広がるファンアウトパタ  
ーンとなる。また、接地あるいは電源用IC接続端子か  
らベタ状の接地配線や電源配線を通じて、接地用あるい  
は電源用の外部接続端子に接続するときには、ベタ状の

接地配線や電源配線を流れる電流も、最短の経路を通るために、概略放射状に電流が流れると考えられる。なお、上記の説明においては、各絶縁層を貫通して上下層を接続するビアは省略して説明している。

【0004】一方、基板の表面あるいは裏面にコンデンサを搭載する場合には、上記したように、コンデンサの両端をそれぞれ接地電位及び電源電位に接続するため、基板表面（または裏面）に設けたコンデンサパッドからビアを通じて、基板内部の接地配線や電源配線と接続するようにする。なお、このコンデンサパッドは、搭載するコンデンサの電極形状にもよるが、一般に、1対のコンデンサパッドが、「＝」状に平行に形成され、各パッドは略長方形にされることが多い。ここで、コンデンサと接地配線や電源配線との接続抵抗が大きくなるとノイズ除去能力が低下するため、できるだけ低抵抗の接続とすべく、できるだけ多くのビアを形成して両者を接続することが多く、コンデンサパッドの長手方向に沿って可能な限り間隔を狭く（詰めて）ビアを列設し、ビア同士の間隔を保ちつつ基板内部に延びるようにする場合が多い。

【0005】

【発明が解決しようとする課題】しかしながら、コンデンサパッドの長手方向と、上記したベタ状の接地配線や電源配線を流れる電流の向き、あるいは、信号配線の拡がる向きとの関係において、不都合が生じる場合がある。基板の表面（あるいは裏面）にどの様にコンデンサを配置するかは、要求される基板の特性やコンデンサの取付の容易さ等を考慮して決められるため、コンデンサパッドの長手方向が、ベタ状の接地配線等を流れる電流の向きおよび信号配線の拡がる方向である基板中央から周縁に向かう放射状の向きと、交差する向きになることがある。ここで、列設されたビアがベタ状の接地配線層や信号配線層を越えて反対面（裏面あるいは表面）側に延びる場合には、狭い間隔で列設されたビアと絶縁を保ちながらこの間を通るようにして、ベタ状の接地配線等の一部を形成したり、信号配線を形成することは困難である。従って、接地配線層等においては、列設されたビアとの絶縁を保つべく、コンデンサパッドの長手方向と略同方向に延びる絶縁パターンが形成される。このため、接地配線層等を流れる電流は、この絶縁パターンの周りを迂回して流れることになるので相対的に抵抗が高くなる。また、信号配線も、列設されたビアの周りを迂回するように形成されるので、信号配線の抵抗が増え、距離が長くなることにより信号の遅延を生じる。

【0006】図6に示す多層配線基板00を参照して説明する。この基板00の表面00Aには、ICチップICをフリップチップ接続で装着するフリップチップパッド31が多数形成され、さらに、積層セラミックチップコンデンサConをハンダSRで固着・搭載するための略長方形のコンデンサパッド32も形成されている。

また、裏面00Bには、ビンパッド33が形成され、ビン81が固着されている。5層の絶縁層1～5の絶縁層間11～14には、フリップチップパッド31とビア41～44を介して接続する接地配線層51、57、電源配線層53、および信号配線56が形成され、これらは、ビア73～75を介してそれぞれビンパッド33及びビン81に接続している。このビン81のうち、ビン81aが接地端子、ビン81bが電源端子となる。また、ビアとビアとの間には、ビア相互の接続を確実にするために、ビアパッド34～37も形成されている。コンデンサConは、コンデンサパッド32の長手方向（図中前後方向）に列状に並ぶビア61～64（列設ビア61～64）の群によって、それぞれ接地配線層51、57および電源配線層53に接続しており、回路的に見ると、この2層の間に介在し、いわゆるデカップリングコンデンサとして、これらの間に生じるノイズを除去する働きをもつ。1つの群に属する列設ビア61～64同士は、できるだけ小さな間隔で多くのビアを形成するようにされる。形成できるビアの数を多くして、電源配線層や接地配線層との接続抵抗をできるだけ小さくするためである。

【0007】ここで、第2絶縁層間12に形成された電源配線層53等の様子を表面00A側から平面視かつ透視すると、図7(a)のようになる。なお、本明細書では、平面図においてその上下に形成されたビアの配置を示すため、考察している絶縁層間で隣接する上下2層の絶縁層（本例で言えば、第2絶縁層間12で隣接する絶縁層2、3）のうち、紙面上側にある絶縁層（本例で言えば、絶縁層2）に形成されているビアを×印で、紙面下側（本例で言えば、絶縁層3）に形成されているビアを○印で表すことにする。従って、ビアが上下方向に重なって形成されている場合には、×印と○印をが重なって描かれる場合もある。第2絶縁層間12に拡がって形成された電源配線層53には、フリップチップパッド31からビア41を介して（×印で示すように）ビア42が接続し、また、ビン81からビア75、74を介して（○印で示すように）ビア73が接続している。従って、この電源配線層53のうち、ビア42の接続点とビア73の接続点との間で、電流が流れることになる。なお、ビア42のうちには、電源配線層53には接続されず、ビアパッド35を介してビア43と接続して裏面00b側に延びるものもある。

【0008】ところで、第2絶縁層間12には、コンデンサパッド32から延びる列設ビア62、63同士を接続する列設ビア接続導体層54と、第2絶縁層間12に拡がる電源配線層53との間を絶縁するため、図7

(a)において上下方向に長い、従って、図6において前後方向に長い、略口字状の絶縁パターン92が形成されている。コンデンサパッド32が、図6において前後方向に長い略長方形にされているためである。ここで、

切断線C-C'上のビア42aとビア73aについてみると、この切断線C-C'上に列設ビア接続導体層54および絶縁パターン92も位置しているため、この間を流れる電流は、図7(a)において破線で示すように、列設ビア接続導体層54および絶縁パターン92を迂回するようにして流れることになる。このため、電流の通る経路が長くなり、この間の抵抗が高くなる。つまり、このようなパターンによって電源配線層53の接地抵抗が上昇することになる。

【0009】同様に、第3絶縁層間13に形成された信号配線56等の様子を表面00A側から平面視すると、図7(b)のようになる。この場合も、列設ビア63同士を接続する列設ビア接続導体層55を有するため、切断線C-C'上に形成されたビア43aとビア74aとを結ぶ信号配線56aは、列設ビア接続導体層55を避けて大きく迂回することになる。このため、信号配線56aの長さが長くなり、その抵抗が上昇し、信号に遅延が生じる。

【0010】本発明は、かかる問題点に鑑みてなされたものであって、基板の表面あるいは裏面にコンデンサパッドを備えながらも、このコンデンサパッドから延びる列設ビア群の列設方向を転換して、ベタ状の接地配線層や電源配線層において電流を流れやすくして抵抗を低減することを目的とする。さらには、信号配線を短距離で結ぶことを可能とし、低抵抗の信号配線を持つ基板を提供することを目的とする。

【0011】

【課題を解決するための手段、作用及び効果】そしてその解決手段は、表面と裏面とを有し、上記表面の一部を占める領域であって、その内部にIC接続端子を多数含む端子形成領域と、上記表面または裏面に形成され、ICチップに接地電位を供給するための接地端子および電源電位を供給するための電源端子を含む多数の外部接続端子と、上記表面または裏面に形成され、コンデンサを接続するコンデンサパッドと、を備える多層配線基板であって、上記コンデンサパッドが形成された面との間に少なくとも2層の絶縁層が介在する絶縁層間に形成され、上記IC接続端子と上記接地端子または電源端子とを導通する導通路の一部を構成し、上記多層配線基板を平面視かつ透視したときに、少なくとも上記端子形成領域と上記導通される接地端子または電源端子との間に広がるベタ導体層を備え、上記コンデンサパッドは、上記多層配線基板を平面視かつ透視したときに、上記端子形成領域と上記ベタ導体層に接続する上記接地端子または電源端子とを結ぶ仮想線上にあり、しかもその長手方向が上記仮想線に交差して配置されており、上記コンデンサパッドから延びるビア群であって、少なくともコンデンサパッドが形成される面を構成する絶縁層においてコンデンサパッドの長手方向に並び、上記ベタ導体層と絶縁を保ちつつ、このベタ導体層が形成された上記絶縁層

間を越えて反対面側に向けて延びるビア群を備え、上記ビア群は、上記ベタ導体層よりも上記コンデンサパッドが形成された面側に位置し隣接する2層の絶縁層のうち、上記コンデンサパッド側の絶縁層に形成されたビア群が、上記コンデンサパッドの長手方向に並ぶ1つの列設ビア群を構成し、上記コンデンサパッドと反対面側の絶縁層に形成されたビア群が、上記仮想線に略平行な方向に並ぶ1または複数の転換ビア群を構成し、上記2層の絶縁層間に形成され、上記列設ビア群と上記転換ビア群とを導通する転換導体層を備え、上記転換ビア群またはこれより上記反対面側に延びる転換延長ビア群の各ビアとベタ導体層との間に、両者間の絶縁を保ち、上記仮想線に略平行な方向に延びまたは並ぶ形状の絶縁パターンを備えることを特徴とする多層配線基板である。

【0012】本発明の多層配線基板では、ベタ導体層よりもコンデンサパッドが形成された面側に列設ビア群、転換導体層、および転換ビア群を有する。このため、ベタ導体層を挟む2つの絶縁層に形成されるビア群は、転換ビア群、または、この転換ビア群からさらに反対面側に向けて延び転換ビア群と同様に仮想線に略平行な方向に並ぶ転換延長ビア群となる。これにより、ベタ導体層において、この転換ビア群等の各ビアとベタ導体層との間の絶縁を保つために形成される絶縁パターンも、仮想線に略平行な方向に延びまたは並ぶ形状にされる。一方、ベタ導体層は、端子形成領域内のIC接続端子とこのベタ導体層に接続する接地端子（または電源端子）とを導通する導通路の一部を構成するので、上記のように、仮想線に略平行な絶縁パターンは、ベタ導体層の電流の流れを阻害しにくい絶縁パターンとなる。つまり、ベタ導体層の抵抗を減少させ、接地抵抗や電源抵抗の小さな基板を実現することができる。また、端子形成領域内のIC接続端子と外部接続端子のうち信号端子とを結ぶ信号配線を、大きく迂回させないで短距離で結び、あるいは、転換ビア群またはこれから延びるビア群同士の間を通して短距離で結ぶことで、信号配線の持つ抵抗を低下させることもできる。

【0013】ここで、多層配線基板は、絶縁層が多数積層され、絶縁層間のうちの一部には、信号配線層や接地・電源配線層などの導体層が形成される。絶縁層の材質としては、例えば、アルミナ、窒化アルミニウム、ガラスセラミック等のセラミックや、エポキシ樹脂、BT樹脂、PPE樹脂等の樹脂、あるいはこれらとガラス繊維やポリエステル繊維等の無機または有機繊維との樹脂複合材などが挙げられる。また、絶縁層間に形成される信号配線層等の導体層の材質は、絶縁層の材質を考慮して選択すればよいが、例えば、セラミック製絶縁層を用いた場合には、W、Mo、Mo-Mn、Cu、Ag、Ag-Pt、Ag-Pd等が挙げられる。また樹脂や樹脂複合材を用いた場合には、Cu、Ni、Au等が挙げられる。IC接続端子とは、ICチップに形成した端子と接

続するために設けられる接続端子であり、具体的には、フリップチップ接続のためのフリップチップパッドやワイヤボンディング接続のためのワイヤボンディングパッドなどが挙げられる。

【0014】端子形成領域とは、上記基板の表面上の領域であって、上記したIC接続端子をその内部に多数形成した領域を指し、例えば、正方形状や矩形状、ロ字状等の領域が挙げられる。外部接続端子とは、基板の裏面あるいは表面に形成され、マザーボードやコネクタ等の外部機器と接続するための接続端子であり、具体的には、ピン状端子、ボール状端子、ランド状端子などが挙げられ、通常、基板の裏面や表面の周縁部に格子状に配列されてそれぞれPGA、BGA、LGA等の端子構造を構成する。ビア群を構成するビアは、絶縁層を貫通して形成され、絶縁層の上下に形成された配線層や導体層を相互に導通するものであり、スタックドビア、スタガードビアなどの形態が挙げられるコンデンサは、基板とは別部材のコンデンサであり、通常その面積や体積を小さなものとするため、チップコンデンサを用いることが多いが、他のコンデンサでも良い。

【0015】ここで、上記の多層配線基板であって、前記転換ビア群に属するビアの断面積の和は、列設ビア群に属するビアの断面積の和と、等しいかこれよりも多いことを特徴とするのが好ましい。断面積が多いということは、ビア群全体での抵抗が小さくなることを示す。ここで、もし転換しない、通常行うように列設ビアをそのまま（断面積も変えないで）反対面側に向けて延ばした場合と比較すると、転換によってビア群の抵抗が低下することになる。つまり、ビア列設方向転換構造によって、ビアの並ぶ方向を仮想線に略平行にするだけでなく、ビア群自身抵抗をも低下させることができ、さらに基板の性能を向上させられるからである。

【0016】さらに、上記の多層配線基板であって、前記転換導体層が、前記コンデンサパッドが形成された面を構成する絶縁層とこれに隣接する絶縁層との間に形成されていることを特徴とする多層配線基板とすると良い。

【0017】本発明の多層配線基板では、転換導体層が、コンデンサパッドが形成された面を構成する絶縁層とこれに隣接する絶縁層との間に形成されている。つまり、コンデンサパッドが形成された面（例えば表面）を構成する絶縁層に列設ビア群、これに隣接する絶縁層に転換ビア群、およびこれらの絶縁層間に転換導体層が形成される。従って、この転換導体層よりも、コンデンサパッドが形成された面とは反対面側にある絶縁層間に形成されるベタ層体層や信号配線層において、接地抵抗や電源抵抗、信号配線抵抗を低下させることができ、あるいは抵抗の小さな信号配線を容易に形成できるから、このような効果が得られる絶縁層間の数を最も増やすことができる。

【0018】さらに、上記の多層配線基板であって、1つの前記列設ビア群と接続する前記転換ビア群を複数備える場合において、上記列設ビア群における各ビア同士の前記コンデンサパッドの長手方向の間隔に比して、隣接する転換ビア群にそれぞれ属するビア同士の上記長手方向の間隔が広くされていることを特徴とする多層配線基板とすると良い。

【0019】本発明の多層配線基板では、コンデンサパッドの長手方向の間隔について見たとき、列設ビア群におけるビア同士の間隔に比して、隣接する転換ビア群それぞれ属するビア同士の間隔が広くされている。このため、このような転換ビア群または転換延長ビア群が上下の絶縁層に形成されている絶縁層間に形成されたベタ導体層においては、転換ビア群または転換延長ビア群と絶縁を保つために形成する絶縁パターン同士の間、比較的広い幅のベタ導体層を形成することができる。従って、この絶縁パターン間のベタ導体層を通して、IC接続端子-接地端子（または電源端子）間の電流が流れるので、さらに接地抵抗や電源抵抗の小さな基板を実現することができる。また、このような転換ビア群または転換延長ビア群が上下の絶縁層に形成されている絶縁層間では、ビア群同士の間隔を広くできるので、この間に寸法的にも形状的にも信号配線を形成しやすくなり、抵抗の小さな信号配線を容易に形成できる。また、このビア群間に複数の信号配線を通すことが可能となる場合もあり、その場合には、より多くの信号配線を短距離で結んで、その抵抗を低下させることができる。

【0020】またさらに、前記転換ビア群同士、または前記転換延長ビア群同士に挟まれた信号配線を備えることを特徴とする多層配線基板とすると良い。

【0021】本発明の多層配線基板では、転換ビア群同士等の間に信号配線を形成したので、信号配線の長さをより短距離にすることができるから、信号配線の持つ抵抗をより低減することができる。

【0022】

【発明の実施の形態】本発明の実施の形態を、図面と共に説明する。本実施形態の基板100は、上記した従来の基板00と、コンデンサパッド32から延びるビアの並び方およびその近傍の形状等が異なるのみであるので、異なる部分を中心に説明し、同じ部分については同じ番号を付して説明を省略または簡略化する。断面図図1、および表面100Aから見た状態の説明図図2

(a)に示すように、この基板100の表面100Aの略中央の端子形成領域31Sにおいて、ICチップICを接続するためのフリップチップパッド31が格子状に多数形成され、さらに、同じく表面100A上にコンデンサConを固着・搭載するための略長方形のコンデンサパッド32も形成されている。また、裏面100Bの周縁近傍には、格子状にピンパッド33が形成され、ピン81が固着されている。前記しなかったが、図2

(a)に示す基板表面100Aの様子は、前記した従来の基板00においても同じである。

【0023】この基板100は、アルミナを主成分とするセラミック製で、5層の絶縁層1、102、103、4、5が積層されており、これらの絶縁層間111、112、113、14には、フリップチップパッド31とビア41～44を介して接続する接地配線層51、57、電源配線層153、および信号配線156が形成され、これらは、ビア73～75を介してそれぞれピンパッド33及びピン81に接続している。このピン81のうち、ピン81aは接地端子、ピン81bは電源端子である。また、ビア41～44、ビア74、75の間の絶縁層間には、ビアとビアとの間の位置ずれを吸収し確実に接続するためのビアパッド34～36、37が形成されている。これらのパッド、配線層及びビアは、いずれもタングステンを主成分とする導体からなり、セラミック製の絶縁層と共に同時焼成法によって形成される。コンデンサConも、従来の基板00(図6参照)と同様に、コンデンサパッド32の長手方向(図中前後方向)に列状に並ぶ列設ビア61(61a、61b)、62の群によって接地配線層51および電源配線層53に接続されて、回路的にデカップリングコンデンサとして機能している。次述するように、転換ビア162や転換延長ビア163、164によって、接地配線層57とも接続している。また、列設ビア61、62同士の間隔も従来と同様に、抵抗を小さくするためできるだけ小さな間隔とされている。

【0024】ついで、第1絶縁層間111に形成された接地配線層51等の様子について、表面100A側から平面視かつ透視した状態を図2(b)に示す。接地配線層51は、絶縁層間111のうち、中央部を除く略全面に広がる導体層である。フリップチップパッド31から延びるビア41のうちのいくつか(本例では、×印で示す3本)が、この接地配線層51に接続している。その他は、絶縁層間111に形成されたビアパッド34を介して紙面下方に形成された○印で示すビア42によって下方(裏面側)に向かって延びる。コンデンサパッド32から絶縁層1内を裏面100B側に向けて延びて、絶縁層間111に延出した列設ビア61のうち、図中向かって右側の列設ビア61bの群(図において3ヶ)は、列設ビア接続導体層52で互いが接続し、その周りには、接地配線層51と絶縁を保つため、略口字状の絶縁パターン91が形成されている。なお、列設ビア接続導体層52には、列設ビア61bとそれぞれ上下同じ位置に形成され、裏面100B側に向かって延びる列設ビア62が接続している。

【0025】一方、列設ビア61のうち、図中向かって左側の列設ビア61aの群(図において3ヶ)は、それぞれ×印で示すように接地配線層51に接続している。さらに、この列設ビア61aは裏面100B側に向けて

延び、もう1つの接地配線層57に接続するのであるが、各列設ビア61と上下同じ位置に形成されない。図2(b)中、○印で示すように、列設ビア61a(61a1、61a2、61a3)が切断線C-C'に対して直交する向き(図2(b)中、紙面上下方向)に並んでいるのに対し、転換ビア162を、切断線C-C'と平行の向き(図2(b)中、紙面左右方向)に2つずつ並べる。これにより、3ヶのビアからなる1つの列設ビア61aの群を、それぞれ2つの転換ビア162が属する2つの転換ビア162の群にしている。即ち、転換ビア162a、162bからなる群162G1と、同じく転換ビア162c、162dからなる群162G2である。しかも、3ヶの列設ビア61aのうち、両端の列設ビア61a1、61a3の図中左右に各々転換ビア162が1ヶずつ配置されるようにした。このため、2つの転換ビアの群162G1、162G2にそれぞれ属するビア同士の間隔は、列設ビア61a同士の間隔の2倍になる。

【0026】次に、第2絶縁層間112に形成された電源配線層153等の様子を表面100A側から平面視かつ透視すると、図3(a)に示すようになる。第2絶縁層間112に広がって形成された電源配線層153には、フリップチップパッド31からビア41を介して(×印で示すように)ビア42が接続し、また、ピン81からビア75、74を介して(○印で示すように)ビア73が接続している。接地配線層153のうち、ビア42の接続点とビア73の接続点との間で、電流が流れることになるのは、前記基板00と同様である。ここで、本実施形態では、上記したように列設ビア61aの群が並ぶ方向は、接地配線層51を介して転換ビア162の群162G1、162G2によって、その方向が転換されている。このため、前記した従来の基板00の場合と異なり(図7(a)参照)、1つの群を成す(本例では2つの)転換ビア162同士を接続する転換ビア接続導体層154a、154bは、その長手方向が切断線C-C'に略平行に形成される。なお、この切断線C-C'は、図3(a)中一点鎖線で示す端子形成領域31Sと電源端子81bとを結ぶ仮想線にもなっている。更にいえば、電源配線層153に接続するビア42aとビア73aとを結ぶ仮想線になっている。しかも、上記したように、この2つの群162G1、162G2の間隔が広くされているので、転換ビア接続導体層154a、154bの周りに、電源配線層153との絶縁のための図中横長略口字状の絶縁パターン192a、192bをそれぞれ形成しても、その間に、電源配線層153sを形成することができる。

【0027】従って、ビア42の接続点とビア73の接続点との間に流れる電流は、図中破線で示すようになり、その一部は絶縁パターン192a、192bの間の電源配線層153sを通る距離の短い経路を取る。従っ



て、従来の場合に比較して、電源配線層153の持つ抵抗を減少させることができたことになる。また、電流が電源配線層153sを通ることにより、切断線C-C'上以外に位置するビア42とビア73との間で流れる電流も、図7(b)の場合に比較してその経路が短くなるため、この点からも電源配線層153の抵抗を低下させることになる。そして、転換ビア162と上下同じ位置に形成した転換延長ビア163が、さらに裏面100B側に延びる。

【0028】同様に、第3絶縁層間113に形成された信号配線156等の様子を表面100A側から平面視すると、図3(b)のようになる。この場合も、転換延長ビア163、164同士を接続する転換延長ビア接続導体層155a、155bが有るため、切断線C-C'上に形成されたビア43aとビア74aとを結ぶ信号配線156aは、転換延長ビア接続導体層155aと155bの間を通すことができるので、僅かに迂回するだけで足りる。このため、信号配線156aの長さを短くでき、その抵抗を低下させ、信号の遅延を防止できる。また、信号配線156aが転換延長ビア接続導体層155aと155bの間を通るため、他の信号配線156も短距離でビア間を接続できるようになり、同様に信号配線の抵抗を低下させることができ、遅延も防止できる。

【0029】このように、本実施形態の基板100では、コンデンサパッド32から延びる列設ビア61aの群の並ぶ方向を接地配線層51および転換ビア162の群により変更したので、電源配線層153や信号配線層156の抵抗を低下させることができた。なお、本実施形態では、1つの群を成す転換ビア162(例えば、162aと162b)や転換延長ビア163、164同士を、転換ビア接続導体層154a、154bや転換延長ビア接続導体層155a、155bで相互に接続した。1つのビアに断線が生じた場合、転換ビア接続導体層を形成しておかないと、そのビアの上下につながるビアすべてが不導通になるが、転換ビア接続導体層を形成しておけば、断線したビアのみ不導通となるだけで済み、断線による抵抗の上昇が最小限に抑えられると共に、配線の信頼性も高くできるからである。但し、信頼性等を勘案した上で、ビア同士を接続しないでおくこともできる。この場合には、転換ビア162と電源配線層153との間の絶縁パターンは、切断線(仮想線)C-C'に略平行に並ぶことになる。

【0030】上記実施形態においては、絶縁層1に形成した列設ビア61の群と、絶縁層間111に形成した接地配線層51と、絶縁層2に形成した転換ビア62の群とで列設ビアの方向を転換した。この他、絶縁層2と3及びこれらの絶縁層間12において、上記と同様に列設ビアの方向を転換しても良い。ただし、この場合には、絶縁層間113に形成した信号配線162については、上記実施形態と同様に経路を短くでき、信号配線の抵抗

を低減できるが、絶縁層間112に形成した電源配線層については、前記した従来の基板00における電源配線層53と同じ形状となるので(図6、図7(a)参照)、電源配線層の抵抗を低減することができない。従って、このことから判るように、できるだけコンデンサパッド32に近い位置で列設ビアの方向を転換することが望ましい。つまり、列設ビア61と転換ビア62の両者が接続する転換導体層(上記実施形態における接地配線層51)が、コンデンサパッド32が形成された面(本実施形態では表面100A)をなす絶縁層1とこれに隣接する絶縁層102との間に形成されているようにするのが望ましい。

【0031】上記実施形態においては、列設ビア61の群(3ヶ)を2つの転換ビア162の群(2ヶ×2)にする構造を用いた。また、列設ビアと転換ビアとの両者を接続する導体層として、接地配線層51を用いた。しかし、これに限定されることはなく、他の構造であっても良い。例えば、図4(a)に示すように、図中前後方向に並ぶ5ヶの列設ビア261の群を、図示しない絶縁層の絶縁層間に形成された略長方形の転換導体層251を介して、図中左右方向に2ヶずつ並ぶ転換ビア262a、262b、262cの群に転換しても良い。なお、上記した理由から、転換ビア262a等はそれぞれ転換ビア接続導体層254a、254b、254cによって互いに導通するようにすると良い。このようにすれば、例えば、転換ビア262bと262cとの間、具体的に言えば、転換ビア接続導体層254bと254cとの間に、所定の絶縁間隔を保つようにした絶縁パターン(図示しない)を形成した上で、接地配線層や電源配線層などのベタ状の導体層(図示しない)を形成することができる。また、転換ビア接続導体層254bと254cとの間に、信号配線層を通すことができる。従って、従来のように、列状ビアの群を避けて迂回する必要が無く、矢印で示すように、図中左右方向に電流を流し、あるいは、信号を伝送することができるから、接地配線層などのベタ状導体層の抵抗を引き下げることができ、あるいは、信号配線の抵抗を引き下げ、信号の遅延を防止することができる。

【0032】また、図4(b)に示すように、図中前後方向に並ぶ5ヶの列設ビア361の群を、図示しない絶縁層の絶縁層間に形成された略十字形状の転換導体層351を介して、図中左右方向に並ぶ5ヶの転換ビア362の群に転換する構造にしても良い。なお、転換ビア362はそれぞれ転換ビア接続導体層354によって互いに導通するようにすると良い。このようにした場合も、転換ビア362や転換ビア接続導体層354との間に、所定の絶縁間隔を保つようにした上で、接地配線層などのベタ状の導体層(図示しない)を転換ビア362や転換ビア接続導体層354の近傍まで形成することができる。また、転換ビア362や転換ビア接続導体層354

の近傍に、信号配線層を通すことができる。従って、このようにした場合にも同様に、接地配線層などのベタ状導体層の抵抗を引き下げることができ、あるいは、信号配線層の抵抗を引き下げ、信号の遅延を防止することができる。

【0033】上記実施形態および図4(a)、(b)に示す例では、列設ビアの並ぶ方向と、転換ビアの並ぶ方向とが基板を略直交する場合について示した。しかし、本発明は、列設ビアの群によって、ベタ状導体層を流れる電流が妨げられたり、信号配線層の経路が迂回させられたりするのを防止して、ベタ状導体層や信号配線層の抵抗を下げる等の効果を得るものであるもので、直交していなくとも良いことは明らかである。例えば、図4

(c)に示すようなものでも良い。図4(c)は、転換導体層451を形成する絶縁層間を基準として、基板を平面視しかつ各絶縁層を透視したときの状態で示してある。上層(紙面上側)の絶縁層に形成され×印で示す5ヶの列設ビア461の群は、図中上下方向に並び、転換導体層451に接続している。一方、下層(紙面下側)の絶縁層の形成され○印で示す転換ビア462a、462b、462cの群は、図中右上がりの斜め方向にそれぞれ2ヶずつ並び、同様に転換導体層451に接続している。また、転換ビア462a等はそれぞれ転換ビア接続導体層454a、454b、454cによって互いに導通されている。このようにした場合、例えば、図4

(c)に示すように、転換ビア462a、462bとの間、つまり転換ビア接続導体層454aと454bとの間に、信号配線層456を通すことにより、斜め方向に信号配線層の経路を短くすることもできる。また、信号配線層456に代えてベタ導体層をこの間に形成することで、ベタ層の抵抗を下げることもできる。

【0034】さらに、上記では、列設ビアの群はいずれも1列に並んでいたが、これに限定されない。例えば、図5(a)に示すように、×印で表す各5ヶの列設ビア561が2列に並んでいる場合にも、転換導体層551を用いて、図中横方向にそれぞれ4ヶの転換ビア562a、562b、562cが3列に並ぶように転換しても良い。この場合、各4ヶの転換ビア562a、562b、562cは、紙面より下側の層間において、それぞれ転換ビア接続導体層554a、554b、554cにより互いに接続される。また、図5(b)に示すように、×印で表す5ヶの列設ビア661がジグザグに並んでいる場合にも、転換導体層651を用いて、図中横方向に3ヶの転換ビア662a、662bが2列に並ぶように転換しても良い。この場合、各3ヶの転換ビア662a、662bは、紙面より下側の層間において、それぞれ転換ビア接続導体層654a、654bにより互いに接続される。

【0035】なお、上記実施形態、図4、および図5に示す列設ビア方向転換構造では、いずれも列設ビアの数

に比して、転換ビアの合計の数が等しいかそれよりも多くなるようにされている。デカップリングコンデンサの機能を十分得るため、コンデンサパッドと接地配線層または電源配線層と間の接続抵抗は、できるだけ小さいことが望ましい。各ビアの断面積が等しいとすれば、コンデンサパッドから延びる列設ビアの数に比して、転換ビアの数を少なくすれば、コンデンサパッドと接地配線層との接続抵抗が上昇することになるので、転換ビアの数をむしろ多くするのが望ましいからである。同様の理由から、各ビアの断面積を変更できる場合には、列設ビアの断面積の合計に比して転換ビアの断面積の合計を等しいか多くするのが好ましい。また、上記実施形態や図4(c)では、転換ビア(または転換延長ビア)の群同士の間を通す信号配線が1本の場合を示したが、複数本であっても良いことは明らかである。さらに、上記実施形態では、各転換ビア接続導体層が互いに平行である例を示したが、必ずしもこれらが平行でなくとも良く、例えば、基板を平面視かつ透視したときに、端子形成領域を中心として放射状になるように形成しても良い。

【0036】以上において、本発明を実施形態および各種の変形例に即して説明したが、本発明は上記実施形態や変形例に限定されるものではなく、その要旨を逸脱しない範囲で、適宜変更して適用できることはいうまでもない。例えば、上記実施形態の基板100では、コンデンサパッド32がICチップICを搭載する表面100Aに形成されていたが、逆側の裏面100Bに形成されたものに本発明を適用しても良い。また、上記実施形態の基板100では、ピンパッド33およびピン81が裏面100Bの周縁近傍に形成されていたが、表面100Aに形成されたものに本発明を適用しても良い。また、基板の表面または裏面に搭載するコンデンサは、1つとは限らず複数でも良い。従って、これらのコンデンサを取り付けるコンデンサパッドから延びる列設ビアについて、本発明の列設ビア方向転換構造を基板の各所で適用しても良いことは明らかである。

#### 【図面の簡単な説明】

【図1】実施形態1に掛かる多層配線基板の構造を示す部分破断断面図である。

【図2】図1の多層配線基板において、(a)は表面に形成されたIC接続端子およびその上下の絶縁層に形成されたビア配置の様子を示す説明図、(b)は第1絶縁層間に形成された導体層(転換導体層)およびその上下の絶縁層に形成されたビア配置の様子を示す説明図である。

【図3】図1の多層配線基板において、(a)は第2絶縁層間に形成されたベタ導体層およびその上下の絶縁層に形成されたビア配置の様子を示す説明図、(b)は第3絶縁層間に形成された信号配線層およびその上下の絶縁層に形成されたビア配置の様子を示す説明図である。

【図4】他のビア転換構造の例を示す説明図であり、

15

(a) は転換ビア群を 1 列にしたもの、(b) は実施形態 1 と同様であるが、転換導体層が独立したもの、

(c) は列設ビア群を結ぶ方向と転換ビア群を結ぶ方向とが斜めになっているものを示す。

【図 5】他のビア転換構造の例を示す説明図であり、

(a) は列設ビア群が 2 列であるもの、(b) は列設ビア群が千鳥状に配置されたものを示す。

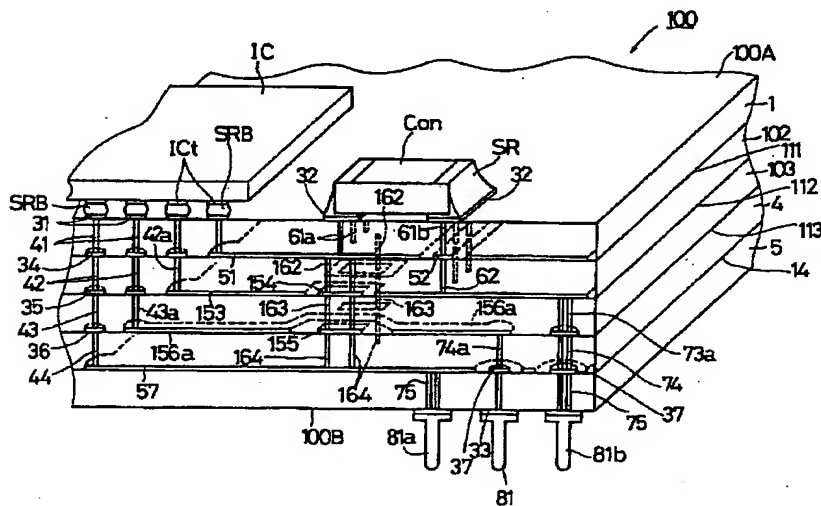
【図 6】従来の多層配線基板の構造を示す部分破断断面図である。

【図 7】図 6 の多層配線基板において、(a) は第 2 絶縁層間に形成されたベタ導体層およびその上下の絶縁層に形成されたビア配置の様子を示す説明図、(b) は第 3 絶縁層間に形成された信号配線層やその上下の絶縁層に形成するビア配置の様子を示す説明図である。

【符号の説明】

100	多層配線
基板 (基板)	
1, 102, 103, 4, 5	絶縁層
111, 112, 113, 14	絶縁層間
31	フリップ
チップパッド	
31S	端子形成
領域	
32	コンデン
サパッド	*

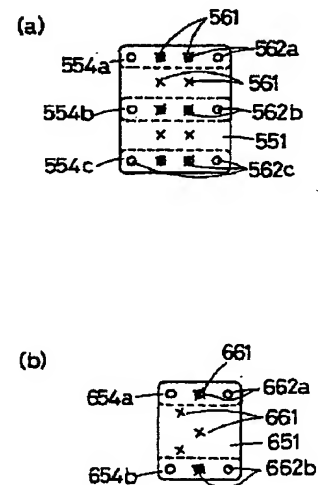
【図 1】



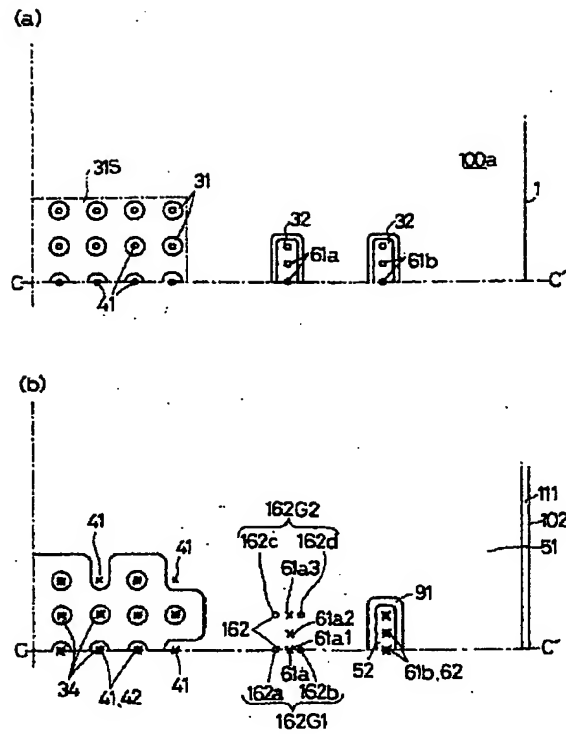
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* 33	ビンパッ
ド	
34, 35, 36, 37	ビアパッ
ド	
41, 42, 43, 44	ビア
51, 57	接地配線
層	
153	電源配線
層	
154	転換ビア
接続導体層	
155	転換延長
ビア接続導体層	
61, 62	列設ビア
162	転換ビア
163, 164	転換延長
ビア	
73, 74, 75	ビア
81	ピン
20 261, 361, 461, 561, 661	列設ビア
251, 351, 451, 551, 651	転換導体
層	
262, 362, 462, 562, 662	転換ビア
254, 354, 454, 554, 654	転換ビア
*	接続導体層

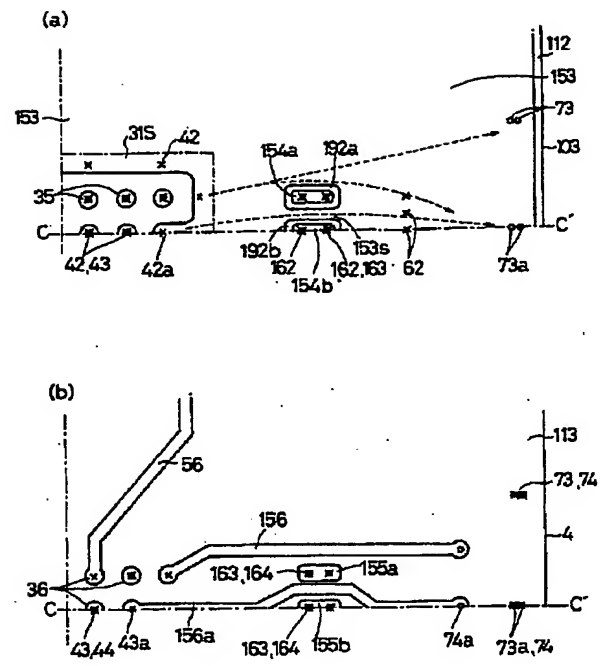
【図 5】



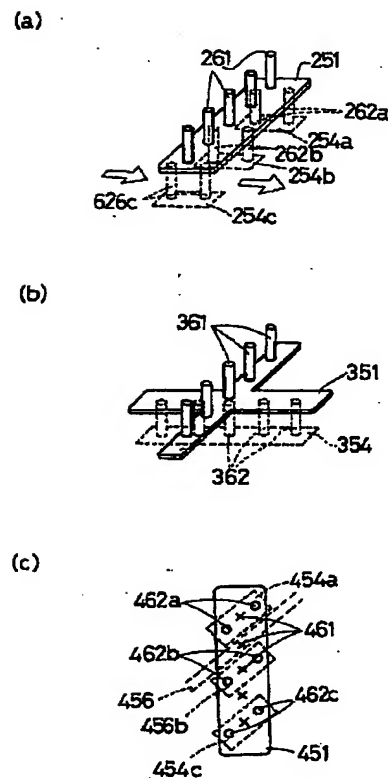
【図 2】



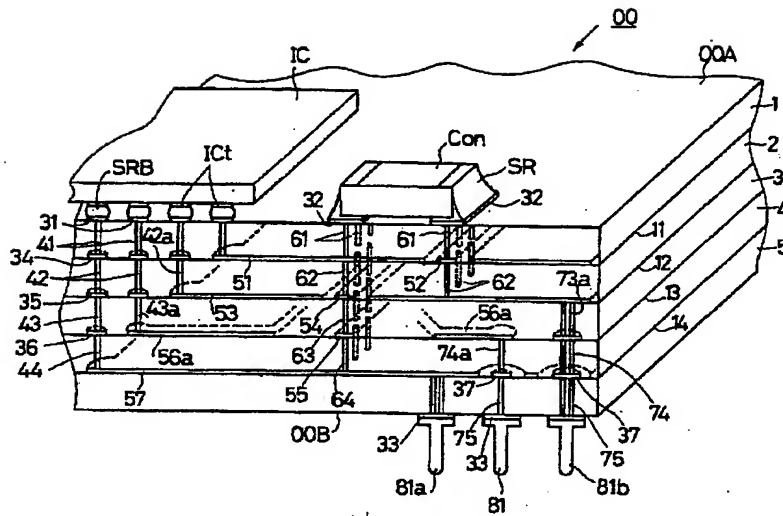
【図 3】



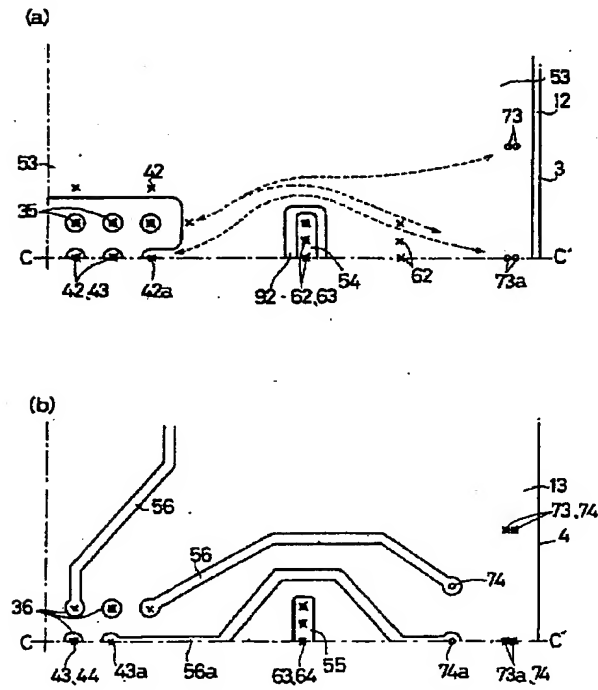
【図 4】



【図 6】



【図 7】



フロントページの続き

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